
Space Weather Technical Forecast

Issued on Saturday, 28 May 2022 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance of radio blackouts. Risk G1/G2 Minor to Moderate Storm intervals into start of UTC weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with GOES16 recording occasional low-level C-class X-ray flares, with the background flux at B-class. There are currently five numbered sunspot regions on the Earth-facing side. AR3017 is now transitioning onto the western limb and has faded from imagery, though this is most likely due to foreshortening effects. All other regions on the disc were small and simple, with no significant flares observed. No earth directed CMEs have been observed in coronagraph imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as observed by DSCOVR at L1, showed an enhancement from 300 km/s to nearly 500 km/s through the period, this initiating around 27/1200 UTC. Density was above average, rising to a peak of 44ppcc before gradually falling back to average by 27/2000 UTC. The IMF was weak until 27/1000 UTC when it became moderate, rising to strong with a peak of 18nT around 27/1200 UTC, before generally becoming moderate thereafter. The north south variation ranged between +12/-16nT. The phi angle showed a switch in orientation around 27/1000UTC from positive (away from the sun), to negative (towards the sun). These solar parameter features are indicative of the CIR ahead of, and subsequent entry into the HSS of CH84/- and/or CH85/-. The net effect of the above solar wind was mainly Quiet, with one Active period and a G1/Minor Storm interval (which has recent been reclassified from the initial Active) over the past 24 hours.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at Background levels through the last 24 hours. The high energy electron flux (greater than 2 MeV) has been at Normal Background to Moderate levels, with a peak value of 498pfu at 27/1325UTC. Corresponding electron fluence has remained well below the Active threshold (1e8 integrated pfu), with a recent sharp decline, and a reading of 5.1e6 integrated pfu observed at 28/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is now expected to be mainly Low, with AR3014 now having left the disc and AR3017 transitioning onto the western limb. The daily risk of M-class flares is now assessed as a Slight Chance. There are no obvious bright flux regions over the eastern limb at present, and any increase in activity would therefore probably need to arise from development of the current quiet front side.

Solar Wind / Geomagnetic Activity: One CME features in the current forecast, that emitted on 25 May from the M1.3 flare from Ex-3016. This may arrive during the current fast wind from CH84/- and/or CH85/-. If this occurs, it will likely bring elevated wind speeds, giving a peak of G1/Minor Storm during Saturday 28 May, with a slight chance of G2/Moderate Storm. Conditions should become less disturbed later in the UTC weekend, becoming Quiet into the new working week.

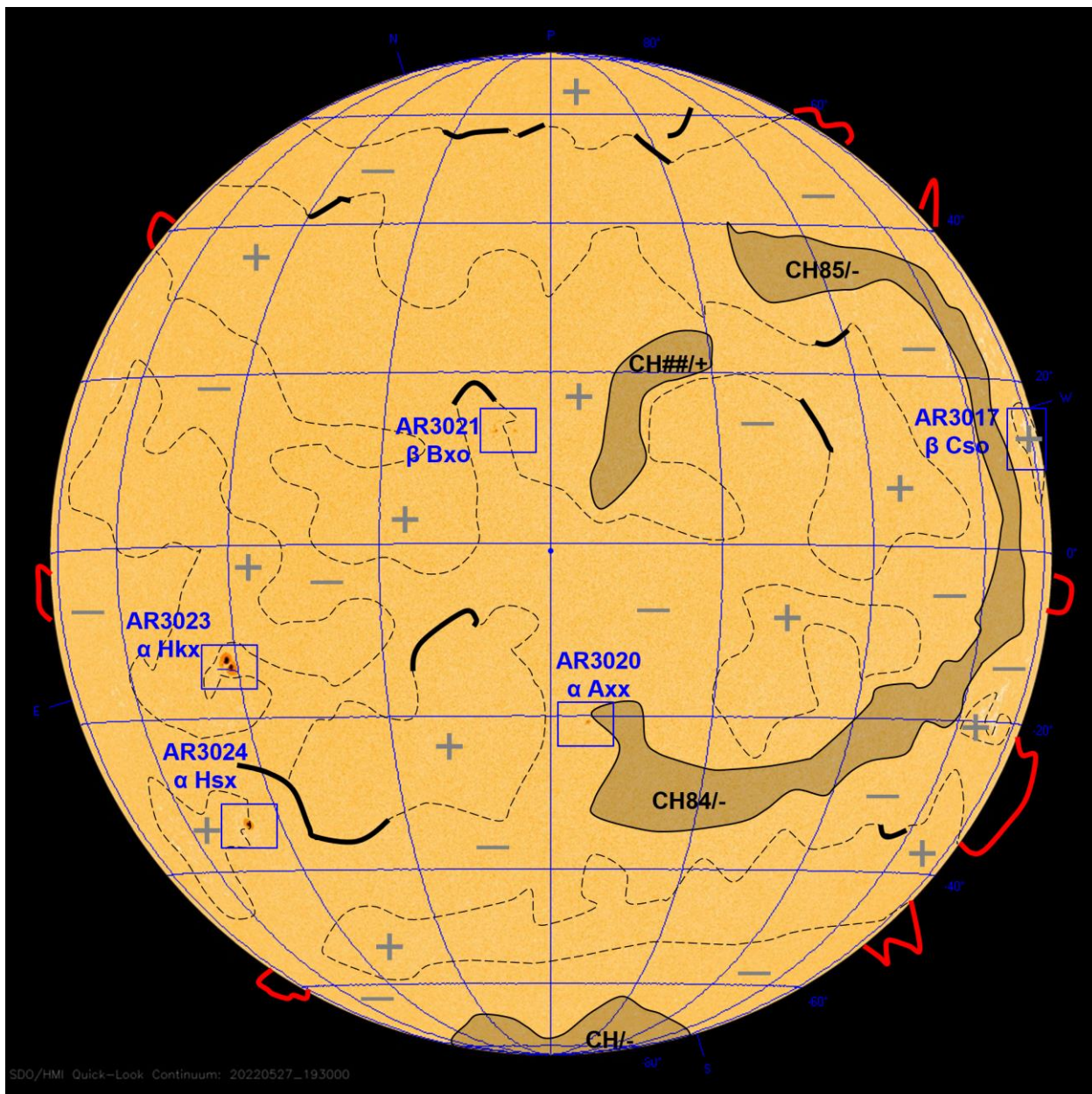
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is

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expected to be at Background levels during this period, with a Very Slight Chance on day 1 (28th) due to the location of AR3017.

High energy electron flux (greater than 2MeV) is expected to remain near its present diurnal oscillation in the immediate term, with a probable reaction upwards in response to the high speed stream(s) of CH84/- and/or CH85/-. The risk of any exceedence of Active in the forecast should peak into the new working week (perhaps becoming Likely), with any geomagnetic activity from the intervening fast wind stream(s) and CME likely to be waning.

Figure 1. Solar Analysis Valid 27/2000 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

One CME features in the current forecast, that emitted on 25 May from the M1.3 flare from Ex-3016.

The Earth is currently experiencing the fast wind from one or both of coronal hole(s) CH84/- or CH85/-. Although later than originally expected, there may be a strong latitudinal difference in onset due to its unusual 'reversed C' shape.

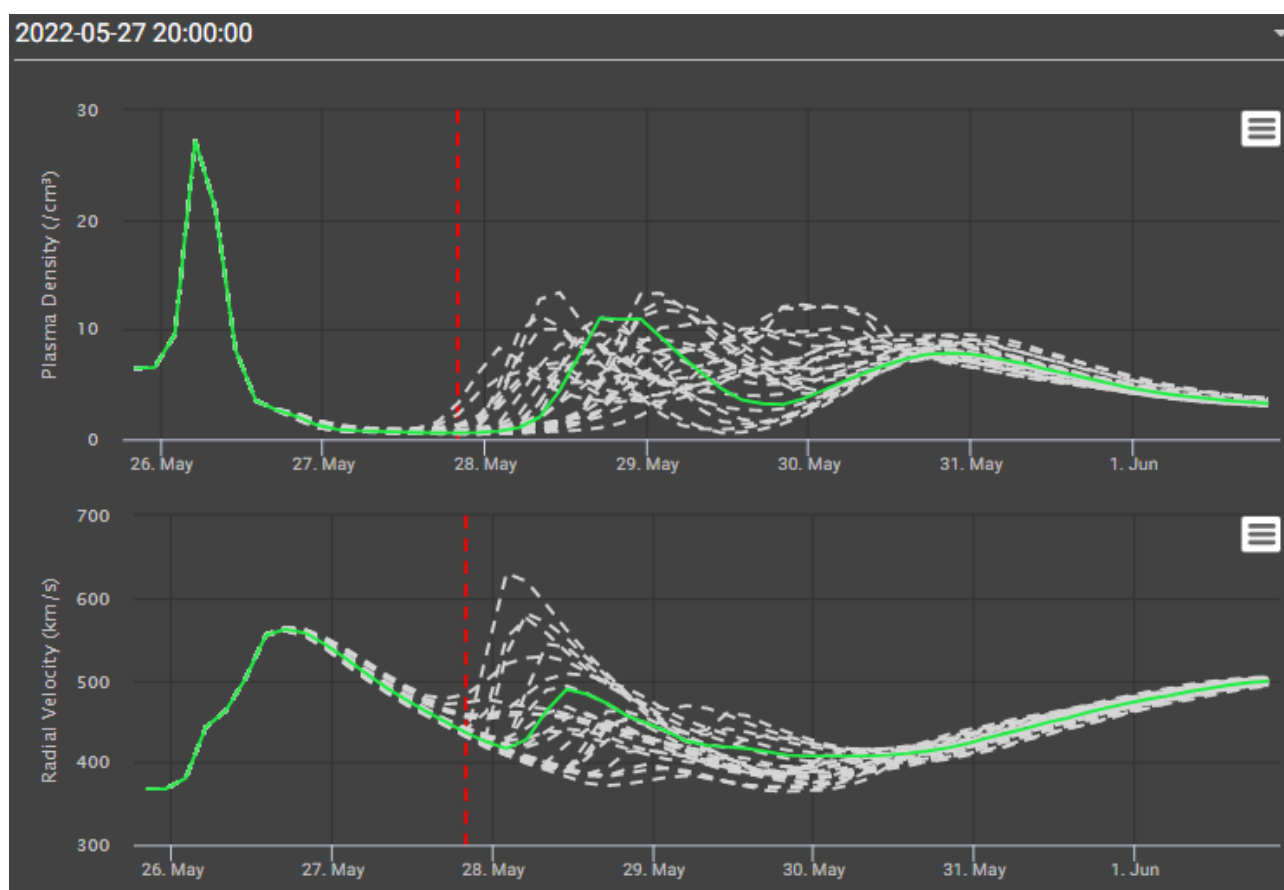
The effects the CME arrival during UTC Saturday will combine with the HSS, bringing a likely G1 with a slight chance of G2. Conditions should become less disturbed later in the UTC weekend, mostly Unsettled or Active by Sunday and becoming Quiet by Monday or Tuesday, with no other enhancements currently expected.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	60	10	1	1
Strong	G3	No	2	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
25/2200	Partial	EX-AR3016	40W 20S	1010 km/s	Early 28 th UTC	Glancing blow

Figure 2: ENLIL CME arrival ensemble.



Radio Blackouts - X-Ray Flares:

A slight chance of M-Class flares remains for day 1 (28th) due to AR3017's location on the western limb. As AR3014 and AR3017 rotate further off the earth facing disk, there will be a decrease in flare risk from day 2 (29th) as there only remains a relatively benign Earth-facing disc comprising mainly stable and unipolar groups.

With no obvious returning regions due over the eastern limb in the coming four days, any rise in flare risk would need to be home-grown on the Earth-facing side.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	5	3	3
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at Background levels and is most likely to remain so through the period.

There is a very slight risk of increased proton flux, and solar radiation storms due to the location of AR3017 on the western limb during day 1 (28th), but this risk reducing further day 2 onward (29th-31st) as it rotate off the visible disk entirely.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	5	2	1	1
Very Active	$\geq \text{S3}$ *	No	1	1	1	1
* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)						

High Energy Electrons Event ($\geq 2 \text{ MeV}$):

The High energy electron flux (as measured by GOES-16) is currently at Normal Background to Moderate levels. In the immediate term, this diurnal oscillation is likely to be attenuated by geomagnetic activity from the fast wind(s) and the 25 May CME, with geomagnetic activity probably sufficient to suppress electron counts through day 1 (28th) and possibly into day 2 (29th)

The chances of Active electron fluence should then increase into the new working week, with the magnitude of any response low confidence, but perhaps becoming Likely to pass Active Monday 30 May onward.

MOSWOC REFM's forecast is currently running counter to the expected evolution, perhaps because its 72-hour range is insufficient to see the expected eventual rise in fluence materialise. Persistence is offering a better guide in this respect, although the fact that the coronal holes differ between rotations and the fact there is a CME expected should mean that details differ.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	5	30	60	60
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 3: REFM, observed, forecast and recurrent integrated flux/fluence.

